

VHSLB

Value Series HARDMAX Longneck Ball

HARDMAX 2 Flutes Short Shank Long Neck Ball End Mills

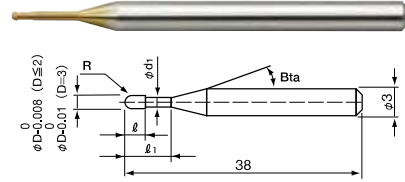
2 Flutes

NEW

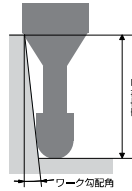
Super MG HARD MAX Shank Dia 0/-0.003

Back Taper Geometry
Except for R0.05~R0.4

R0.05 R0.1~R1.5



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.



Radius of Ball Nose	Diameter Tolerance	Ball Radius Accuracy	Helix Angle
R0.05	0/-0.008	± 0.002	0°
R0.1 ~ R0.75		± 0.003	30°
R1		± 0.004	
R1.5	0/-0.01	± 0.005	

Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS					CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
			~50HRC	~55HRC	~60HRC	~65HRC	~70HRC										
○	○	●	●	●	●	○	○			○			○	○			

Total 53 models

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ_1	Length of Cut ℓ	Neck Diameter ϕd_1	Shank Taper Angle Bta	Effective Length by Inclined Angles					Suggested Retail Price ¥
						30°	1°	1° 30'	2°	3°	
VHSLB 2001-003	R0.05	0.3	0.08	0.093	11°	0.34	0.37	0.39	0.41	0.46	5,820
VHSLB 2002-003	R0.1	0.3	0.16	0.18	16°	0.43	0.45	0.46	0.48	0.52	4,050
VHSLB 2002-005	R0.1	0.5	0.16	0.18	16°	0.64	0.66	0.69	0.71	0.76	4,050
VHSLB 2002-0075	R0.1	0.75	0.16	0.18	16°	0.90	0.93	0.97	1.00	1.07	4,050
VHSLB 2002-010	R0.1	1	0.16	0.18	16°	1.16	1.20	1.24	1.28	1.38	4,050
VHSLB 2003-005	R0.15	0.5	0.24	0.28	16°	0.63	0.66	0.68	0.71	0.75	3,990
VHSLB 2003-0075	R0.15	0.75	0.24	0.28	16°	0.90	0.93	0.96	0.99	1.06	3,990
VHSLB 2003-010	R0.15	1	0.24	0.28	16°	1.16	1.20	1.24	1.28	1.37	3,990
VHSLB 2003-015	R0.15	1.5	0.24	0.28	16°	1.67	1.73	1.78	1.84	1.97	4,280
VHSLB 2003-020	R0.15	2	0.24	0.28	16°	2.19	2.26	2.33	2.41	2.59	4,280
VHSLB 2003-030	R0.15	3	0.24	0.28	16°	3.22	3.33	3.43	3.55	3.81	4,390
VHSLB 2004-005	R0.2	0.5	0.32	0.38	16°	0.63	0.65	0.68	0.70	0.74	2,740
VHSLB 2004-010	R0.2	1	0.32	0.38	16°	1.15	1.19	1.23	1.27	1.35	2,740
VHSLB 2004-015	R0.2	1.5	0.32	0.38	16°	1.67	1.73	1.78	1.84	1.96	2,800
VHSLB 2004-020	R0.2	2	0.32	0.38	16°	2.19	2.26	2.33	2.41	2.57	2,850
VHSLB 2004-030	R0.2	3	0.32	0.38	16°	3.22	3.32	3.43	3.54	3.80	3,140
VHSLB 2004-040	R0.2	4	0.32	0.38	16°	4.25	4.39	4.53	4.68	5.02	3,420
VHSLB 2005-010	R0.25	1	0.4	0.48	16°	1.15	1.19	1.23	1.26	1.34	2,740
VHSLB 2005-015	R0.25	1.5	0.4	0.48	16°	1.67	1.72	1.77	1.83	1.95	2,740
VHSLB 2005-020	R0.25	2	0.4	0.48	16°	2.19	2.25	2.32	2.40	2.56	2,740
VHSLB 2005-025	R0.25	2.5	0.4	0.48	16°	2.71	2.79	2.87	2.97	3.18	2,740
VHSLB 2005-030	R0.25	3	0.4	0.48	16°	3.22	3.32	3.42	3.54	3.79	2,740
VHSLB 2005-040	R0.25	4	0.4	0.48	16°	4.25	4.38	4.53	4.68	5.01	2,740

φ3mm Shank V Series

UDC-PCD Series

CBN Series

Square

Long Neck Square

Radius

Long Neck Radius

Taper Neck Radius

Ball / Long Shank Ball

Long Neck Ball

Taper Neck Ball

Taper

Barrel

Spiral V Cutter

Drill

Technical Data

HARDMAX 2 Flutes Short Shank Long Neck Ball End Mills

Model Number	Radius of Ball Nose R	Effective Length l_e	Length of Cut l_c	Neck Diameter ϕd_1	Shank Taper Angle B α	Effective Length by Inclined Angles					Suggested Retail Price ¥
						30°	1°	1° 30'	2°	3°	
VHSLB 2006-010	R0.3	1	0.48	0.58	16°	1.15	1.19	1.22	1.26	1.33	2,340
VHSLB 2006-015	R0.3	1.5	0.48	0.58	16°	1.67	1.72	1.77	1.82	1.94	2,110
VHSLB 2006-020	R0.3	2	0.48	0.58	16°	2.19	2.25	2.32	2.39	2.55	2,110
VHSLB 2006-025	R0.3	2.5	0.48	0.58	16°	2.70	2.78	2.87	2.96	3.16	2,170
VHSLB 2006-030	R0.3	3	0.48	0.58	16°	3.22	3.32	3.42	3.53	3.78	2,170
VHSLB 2006-040	R0.3	4	0.48	0.58	16°	4.25	4.38	4.52	4.67	5.00	2,230
VHSLB 2006-050	R0.3	5	0.48	0.58	16°	5.28	5.45	5.62	5.81	6.22	2,230
VHSLB 2006-060	R0.3	6	0.48	0.58	16°	6.31	6.51	6.72	6.95	7.45	2,230
VHSLB 2008-020	R0.4	2	0.64	0.78	16°	2.18	2.25	2.31	2.38	2.53	2,110
VHSLB 2008-030	R0.4	3	0.64	0.78	16°	3.22	3.31	3.41	3.52	3.75	2,230
VHSLB 2008-040	R0.4	4	0.64	0.78	16°	4.25	4.37	4.51	4.66	4.98	2,230
VHSLB 2008-050	R0.4	5	0.64	0.78	16°	5.28	5.44	5.61	5.79	6.20	2,230
VHSLB 2008-060	R0.4	6	0.64	0.78	16°	6.31	6.50	6.71	6.93	7.43	2,230
VHSLB 2010-020	R0.5	2	0.8	0.97	16°	2.20	2.26	2.32	2.39	2.54	2,000
VHSLB 2010-025	R0.5	2.5	0.8	0.97	16°	2.72	2.79	2.87	2.96	3.15	2,000
VHSLB 2010-030	R0.5	3	0.8	0.97	16°	3.24	3.33	3.42	3.53	3.76	2,000
VHSLB 2010-040	R0.5	4	0.8	0.97	16°	4.27	4.39	4.52	4.67	4.98	2,000
VHSLB 2010-050	R0.5	5	0.8	0.97	16°	5.30	5.46	5.62	5.80	6.21	2,000
VHSLB 2010-060	R0.5	6	0.8	0.97	16°	6.33	6.52	6.72	6.94	7.43	2,170
VHSLB 2010-080	R0.5	8	0.8	0.97	16°	8.39	8.65	8.93	9.22	9.88	2,170
VHSLB 2015-030	R0.75	3	1.2	1.46	16°	3.12	3.20	3.28	3.37	3.58	2,050
VHSLB 2015-040	R0.75	4	1.2	1.46	16°	4.15	4.26	4.38	4.51	4.80	2,050
VHSLB 2015-060	R0.75	6	1.2	1.46	16°	6.21	6.39	6.58	6.79	7.25	2,050
VHSLB 2015-080	R0.75	8	1.2	1.46	16°	8.28	8.52	8.78	9.07	9.69	2,170
VHSLB 2020-030	R1	3	1.6	1.96	16°	3.11	3.18	3.26	3.34	3.52	2,000
VHSLB 2020-040	R1	4	1.6	1.96	16°	4.14	4.24	4.36	4.48	4.74	2,000
VHSLB 2020-060	R1	6	1.6	1.96	16°	6.20	6.37	6.56	6.75	7.19	2,000
VHSLB 2020-080	R1	8	1.6	1.96	16°	8.27	8.50	8.76	9.03	9.64	2,170
VHSLB 2030-060	R1.5	6	2.4	2.93	—	No Interference	No Interference	No Interference	No Interference	No Interference	2,170
VHSLB 2030-080	R1.5	8	2.4	2.93	—	No Interference	No Interference	No Interference	No Interference	No Interference	2,170

ø3mm Shank V Series

UDC-PCD Series

CBN Series

Square

Long Neck Square

Radius

Long Neck Radius

Taper Neck Radius

Ball / Long Shank Ball

Long Neck Ball

Taper Neck Ball

Taper

Barrel

Spiral V Cutter

Drill

Technical Data

VHSLB Milling Conditions

WORK MATERIAL			COPPER OFC / TPC				CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
2001-003	R0.05	0.3	54,000	85	0.004	0.004	54,000	85	0.004	0.004	54,000	85	0.004	0.004
2002-003	R0.1	0.3	54,000	430	0.01	0.01	60,000	350	0.008	0.016	60,000	350	0.008	0.016
2002-005	R0.1	0.5	54,000	430	0.01	0.01	60,000	350	0.008	0.016	60,000	350	0.008	0.016
2002-0075	R0.1	0.75	54,000	380	0.008	0.008	60,000	320	0.007	0.015	60,000	320	0.007	0.015
2002-010	R0.1	1	54,000	380	0.008	0.008	60,000	250	0.005	0.015	60,000	250	0.005	0.015
2003-005	R0.15	0.5	54,000	720	0.015	0.015	43,000	500	0.012	0.024	43,000	500	0.012	0.024
2003-0075	R0.15	0.75	54,000	720	0.015	0.015	43,000	500	0.012	0.024	43,000	500	0.012	0.024
2003-010	R0.15	1	54,000	640	0.014	0.015	43,000	450	0.008	0.024	43,000	450	0.008	0.024
2003-015	R0.15	1.5	54,000	640	0.014	0.015	43,000	400	0.007	0.021	43,000	400	0.007	0.021
2003-020	R0.15	2	49,000	530	0.011	0.011	40,000	300	0.006	0.018	40,000	300	0.006	0.018
2003-030	R0.15	3	43,000	460	0.009	0.01	38,000	200	0.004	0.012	38,000	200	0.004	0.012
2004-005	R0.2	0.5	54,000	870	0.023	0.036	35,000	1,200	0.02	0.04	35,000	1,200	0.02	0.04
2004-010	R0.2	1	54,000	870	0.023	0.036	35,000	1,200	0.02	0.04	35,000	1,200	0.02	0.04
2004-015	R0.2	1.5	54,000	790	0.022	0.036	35,000	900	0.016	0.033	35,000	900	0.016	0.033
2004-020	R0.2	2	54,000	790	0.022	0.036	35,000	600	0.011	0.033	35,000	600	0.011	0.033
2004-030	R0.2	3	50,000	660	0.017	0.018	35,000	400	0.008	0.024	35,000	400	0.008	0.024
2004-040	R0.2	4	50,000	640	0.012	0.018	35,000	300	0.005	0.015	35,000	300	0.005	0.015
2005-010	R0.25	1	57,000	1,380	0.029	0.054	34,000	1,300	0.03	0.06	34,000	1,300	0.03	0.06
2005-015	R0.25	1.5	57,000	1,380	0.029	0.054	34,000	1,000	0.025	0.05	34,000	1,000	0.025	0.05
2005-020	R0.25	2	57,000	1,250	0.028	0.054	34,000	800	0.023	0.046	34,000	800	0.023	0.046
2005-025	R0.25	2.5	57,000	1,250	0.028	0.054	34,000	700	0.015	0.045	34,000	700	0.015	0.045
2005-030	R0.25	3	55,000	1,010	0.021	0.036	32,000	550	0.012	0.036	32,000	550	0.012	0.036
2005-040	R0.25	4	55,000	1,010	0.021	0.036	31,000	450	0.01	0.03	31,000	450	0.01	0.03
2006-010	R0.3	1	57,000	1,670	0.035	0.144	33,000	1,500	0.04	0.08	33,000	1,500	0.04	0.08
2006-015	R0.3	1.5	57,000	1,670	0.035	0.144	33,000	1,500	0.04	0.08	33,000	1,500	0.04	0.08
2006-020	R0.3	2	57,000	1,540	0.034	0.144	33,000	1,400	0.036	0.072	33,000	1,400	0.036	0.072
2006-025	R0.3	2.5	57,000	1,540	0.034	0.144	33,000	1,200	0.033	0.066	33,000	1,200	0.033	0.066
2006-030	R0.3	3	57,000	1,540	0.034	0.144	33,000	900	0.025	0.066	33,000	900	0.025	0.066
2006-040	R0.3	4	54,000	1,130	0.026	0.108	31,000	700	0.02	0.06	31,000	700	0.02	0.06
2006-050	R0.3	5	46,000	960	0.019	0.072	29,000	440	0.015	0.045	29,000	440	0.015	0.045
2006-060	R0.3	6	46,000	960	0.019	0.072	24,000	380	0.012	0.036	24,000	380	0.012	0.036
2008-020	R0.4	2	55,000	2,060	0.063	0.18	30,000	1,800	0.06	0.12	30,000	1,800	0.06	0.12
2008-030	R0.4	3	55,000	1,860	0.063	0.18	30,000	1,600	0.05	0.1	30,000	1,600	0.05	0.1
2008-040	R0.4	4	55,000	1,860	0.063	0.18	30,000	1,300	0.04	0.1	30,000	1,300	0.04	0.1
2008-050	R0.4	5	47,000	1,410	0.038	0.108	30,000	1,100	0.035	0.1	30,000	1,100	0.035	0.1
2008-060	R0.4	6	47,000	1,410	0.038	0.108	27,000	900	0.025	0.075	27,000	900	0.025	0.075
2010-020	R0.5	2	46,000	2,000	0.072	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.08	0.16
2010-025	R0.5	2.5	46,000	2,000	0.072	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.08	0.16
2010-030	R0.5	3	46,000	2,000	0.072	0.36	24,000	1,600	0.07	0.14	24,000	1,600	0.07	0.14
2010-040	R0.5	4	46,000	2,000	0.071	0.36	24,000	1,500	0.065	0.13	24,000	1,500	0.065	0.13
2010-050	R0.5	5	46,000	2,000	0.071	0.36	24,000	1,400	0.06	0.12	24,000	1,400	0.06	0.12
2010-060	R0.5	6	39,000	1,500	0.071	0.18	18,000	1,200	0.04	0.12	18,000	1,200	0.04	0.12
2010-080	R0.5	8	39,000	1,500	0.043	0.18	16,500	900	0.027	0.081	16,500	900	0.027	0.081
2015-030	R0.75	3	30,000	2,200	0.171	0.324	30,000	1,600	0.12	0.24	30,000	1,600	0.12	0.24
2015-040	R0.75	4	30,000	2,200	0.171	0.324	30,000	1,500	0.11	0.22	30,000	1,500	0.11	0.22
2015-060	R0.75	6	30,000	1,980	0.147	0.324	23,000	1,300	0.1	0.2	23,000	1,300	0.1	0.2
2015-080	R0.75	8	26,000	1,500	0.106	0.27	18,000	1,100	0.08	0.16	18,000	1,100	0.08	0.16

2 Flutes

φ3mm Shank
V Series

UDC-PCD
Series

CBN
Series

Square

Long Neck
Square

Radius

Long Neck
Radius

Taper Neck
Radius

Ball / Long
Shank Ball

Long Neck
Ball

Taper Neck
Ball

Taper

Barrel

Spiral
V Cutter

Drill

Technical Data

VHSLB Milling Conditions

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001-003	R0.05	0.3	48,000	55	0.002	0.002	48,000	45	0.002	0.002	48,000	45	0.002	0.002
2002-003	R0.1	0.3	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003
2002-005	R0.1	0.5	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003
2002-0075	R0.1	0.75	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003
2002-010	R0.1	1	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003
2003-005	R0.15	0.5	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005
2003-0075	R0.15	0.75	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005
2003-010	R0.15	1	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005
2003-015	R0.15	1.5	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005
2003-020	R0.15	2	60,000	210	0.004	0.007	45,000	190	0.003	0.005	43,500	110	0.002	0.004
2003-030	R0.15	3	42,500	140	0.002	0.004	32,000	80	0.002	0.004	32,000	65	0.001	0.002
2004-005	R0.2	0.5	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008
2004-010	R0.2	1	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008
2004-015	R0.2	1.5	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008
2004-020	R0.2	2	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008
2004-030	R0.2	3	40,000	250	0.005	0.008	31,900	210	0.004	0.008	30,500	160	0.003	0.005
2004-040	R0.2	4	32,000	180	0.003	0.005	25,500	150	0.002	0.004	24,300	120	0.002	0.004
2005-010	R0.25	1	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01
2005-015	R0.25	1.5	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01
2005-020	R0.25	2	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01
2005-025	R0.25	2.5	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01
2005-030	R0.25	3	40,000	500	0.01	0.02	31,000	400	0.007	0.01	28,550	230	0.005	0.008
2005-040	R0.25	4	32,700	180	0.005	0.015	27,150	150	0.003	0.008	25,650	100	0.002	0.005
2006-010	R0.3	1	40,000	1,400	0.045	0.15	30,000	1,500	0.03	0.13	26,500	1,000	0.015	0.09
2006-015	R0.3	1.5	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075
2006-020	R0.3	2	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075
2006-025	R0.3	2.5	40,000	800	0.02	0.1	30,000	800	0.015	0.09	26,500	520	0.008	0.065
2006-030	R0.3	3	40,000	800	0.02	0.1	30,000	800	0.015	0.09	26,500	520	0.008	0.065
2006-040	R0.3	4	40,000	500	0.015	0.09	30,000	500	0.01	0.075	26,500	340	0.006	0.05
2006-050	R0.3	5	32,000	400	0.01	0.075	25,000	390	0.007	0.05	23,000	260	0.005	0.04
2006-060	R0.3	6	24,000	300	0.007	0.06	21,000	320	0.005	0.04	19,500	210	0.004	0.03
2008-020	R0.4	2	35,000	1,600	0.06	0.21	27,000	1,600	0.04	0.17	23,500	1,000	0.02	0.12
2008-030	R0.4	3	35,000	1,400	0.05	0.19	27,000	1,400	0.03	0.15	23,500	900	0.015	0.1
2008-040	R0.4	4	35,000	1,200	0.04	0.17	27,000	1,200	0.025	0.135	23,500	600	0.012	0.095
2008-050	R0.4	5	31,500	900	0.03	0.15	25,000	900	0.02	0.12	22,000	500	0.01	0.085
2008-060	R0.4	6	28,000	600	0.02	0.12	23,000	600	0.012	0.095	20,500	400	0.006	0.065
2010-020	R0.5	2	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2
2010-025	R0.5	2.5	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2
2010-030	R0.5	3	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17
2010-040	R0.5	4	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17
2010-050	R0.5	5	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17
2010-060	R0.5	6	30,000	1,150	0.06	0.23	21,500	1,250	0.03	0.17	19,700	1,050	0.025	0.15
2010-080	R0.5	8	24,000	800	0.025	0.155	18,500	580	0.015	0.12	18,400	480	0.015	0.12
2015-030	R0.75	3	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29
2015-040	R0.75	4	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29
2015-060	R0.75	6	30,000	2,450	0.15	0.45	17,000	2,000	0.07	0.31	15,000	1,750	0.04	0.24
2015-080	R0.75	8	23,500	1,300	0.1	0.37	15,000	1,250	0.045	0.25	14,000	1,050	0.03	0.21

- φ3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shank Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

VHSLB Milling Conditions

WORK MATERIAL			HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001-003	R0.05	0.3	36,000	22	0.002	0.002
2002-003	R0.1	0.3	45,000	65	0.002	0.003
2002-005	R0.1	0.5	45,000	65	0.002	0.003
2002-0075	R0.1	0.75	45,000	65	0.002	0.003
2002-010	R0.1	1	45,000	65	0.002	0.003
2003-005	R0.15	0.5	32,500	90	0.003	0.005
2003-0075	R0.15	0.75	32,500	90	0.003	0.005
2003-010	R0.15	1	32,500	90	0.003	0.005
2003-015	R0.15	1.5	32,500	90	0.003	0.005
2003-020	R0.15	2	32,500	55	0.002	0.004
2003-030	R0.15	3	24,000	30	0.001	0.002
2004-005	R0.2	0.5	26,250	120	0.005	0.008
2004-010	R0.2	1	26,250	120	0.005	0.008
2004-015	R0.2	1.5	26,250	120	0.005	0.008
2004-020	R0.2	2	26,250	120	0.005	0.008
2004-030	R0.2	3	22,800	80	0.003	0.005
2004-040	R0.2	4	18,200	60	0.002	0.004
2005-010	R0.25	1	22,500	150	0.007	0.01
2005-015	R0.25	1.5	22,500	150	0.007	0.01
2005-020	R0.25	2	22,500	150	0.007	0.01
2005-025	R0.25	2.5	22,500	150	0.007	0.01
2005-030	R0.25	3	21,400	115	0.005	0.008
2005-040	R0.25	4	19,900	50	0.002	0.005
2006-010	R0.3	1	20,000	500	0.015	0.09
2006-015	R0.3	1.5	20,000	400	0.01	0.075
2006-020	R0.3	2	20,000	400	0.01	0.075
2006-025	R0.3	2.5	20,000	260	0.008	0.065
2006-030	R0.3	3	20,000	260	0.008	0.065
2006-040	R0.3	4	20,000	170	0.006	0.05
2006-050	R0.3	5	18,000	130	0.005	0.04
2006-060	R0.3	6	15,000	105	0.004	0.03
2008-020	R0.4	2	17,500	500	0.02	0.12
2008-030	R0.4	3	17,500	450	0.015	0.1
2008-040	R0.4	4	17,500	300	0.012	0.095
2008-050	R0.4	5	16,500	250	0.01	0.085
2008-060	R0.4	6	15,500	200	0.006	0.065
2010-020	R0.5	2	16,000	875	0.05	0.2
2010-025	R0.5	2.5	16,000	875	0.05	0.2
2010-030	R0.5	3	16,000	875	0.03	0.17
2010-040	R0.5	4	16,000	875	0.03	0.17
2010-050	R0.5	5	16,000	875	0.03	0.17
2010-060	R0.5	6	14,500	525	0.025	0.15
2010-080	R0.5	8	13,800	240	0.015	0.12
2015-030	R0.75	3	11,250	875	0.06	0.29
2015-040	R0.75	4	11,250	875	0.06	0.29
2015-060	R0.75	6	11,250	875	0.04	0.24
2015-080	R0.75	8	10,500	525	0.03	0.21

2 Flutes

φ3mm Shank
V Series

UDC-PCD
Series

CBN
Series

Square

Square

Long Neck
Square

Radius

Radius

Long Neck
Radius

Taper Neck
Radius

Ball

Ball / Long
Shank Ball

Long Neck
Ball

Taper Neck
Ball

Taper

Taper

Barrel

Barrel

Spiral
V Cutter

Spiral
V Cutter

Drill

Drill

Technical Data

Technical Data

VHSLB Milling Conditions

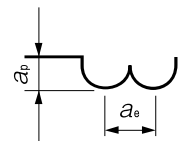
WORK MATERIAL			COPPER OFC / TPC				CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2020-030	R1	3	22,000	2,140	0.232	0.54	30,000	2,000	0.21	0.42	30,000	2,000	0.21	0.42
2020-040	R1	4	22,000	2,140	0.232	0.54	30,000	2,000	0.21	0.42	30,000	2,000	0.21	0.42
2020-060	R1	6	22,000	2,140	0.232	0.54	30,000	2,000	0.21	0.42	30,000	2,000	0.21	0.42
2020-080	R1	8	22,000	1,920	0.185	0.36	30,000	2,000	0.18	0.36	30,000	2,000	0.18	0.36
2030-060	R1.5	6	15,000	2,890	0.278	0.54	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9
2030-080	R1.5	8	15,000	2,890	0.278	0.54	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2020-030	R1	3	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35
2020-040	R1	4	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35
2020-060	R1	6	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	12,250	1,800	0.06	0.3
2020-080	R1	8	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	12,250	1,800	0.06	0.3
2030-060	R1.5	6	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55
2030-080	R1.5	8	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55

WORK MATERIAL			HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min-1)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2020-030	R1	3	9,200	900	0.08	0.35
2020-040	R1	4	9,200	900	0.08	0.35
2020-060	R1	6	9,200	900	0.06	0.3
2020-080	R1	8	9,200	900	0.06	0.3
2030-060	R1.5	6	6,900	950	0.12	0.55
2030-080	R1.5	8	6,900	950	0.12	0.55

Note:

- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when the tool is chattering and heats up to a red color.
- Every coolant offers stable milling.
- Recommend wet coolant for Copper.



- φ3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shank Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

Long neck ball end mill R0.5 x Effective length 6mm

The comparison example of different shank diameter between $\phi 3\text{mm}$ & $\phi 4\text{mm}$

2 Flutes

Comparison of roughness and reflection of the aspherical surface (Finishing process).

The upper surface of the square prism was processed aspherically, and the surface roughness and reflection were compared. We obtained the same results as the $\phi 4\text{mm}$ shank in terms of surface roughness and reflection.

<Condition>

Work material: HAP10(64HRC)

Coolant : Air blow

Tool holder : Hydraulic chuck

(Overhang : 2mm of the shank part)

Milling shape : Aspherical surface ($5\text{mm} \times 5\text{mm}$) R25

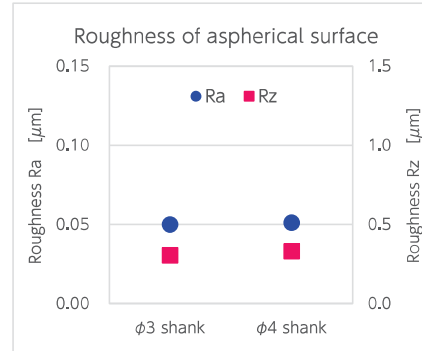
Cycle time : about 26 min.

n : 29,600 min^{-1}

V_f : 500 mm/min

a_p : 0.015 mm

a_e : 0.006 mm



<Aspherical shape photos>

$\phi 3\text{mm}$ shank VHSLB



$\phi 4\text{mm}$ shank HSLB

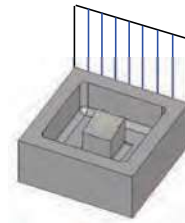
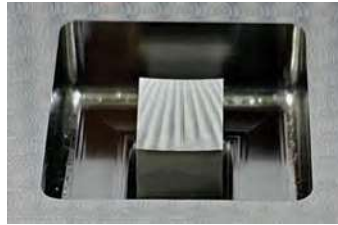


Image of the time of shooting

* These photos were taken as shown in the image on the right so that the blue line printed on the paper would be reflected.

- $\phi 3\text{mm}$ Shank V Series
- UDC-PCD Series
- CBN Series
- Square
 - Square
 - Long Neck Square
- Radius
 - Radius
 - Long Neck Radius
 - Taper Neck Radius
- Ball
 - Ball / Long Shank Ball
 - Long Neck Ball
 - Taper Neck Ball
- Taper
 - Taper
- Barrel
- Spiral V Cutter
- Drill
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